

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

High School

Materials/Preparation

- ☐ Materials/Preparation
- ☐ Teacher Material A –Potting Media Components – one per teacher
- ☐ Handout A – Sorting Out Potting Soil – one per student
- ☐ Assessment A – Sorting Out Potting Soil – one per student
- ☐ 100 ml graduated cylinders
- ☐ 30 ml cup
- ☐ Electronic balances
- ☐ Calculators
- ☐ Ziploc® bags – quart size
- ☐ Permanent marker
- ☐ Paper towels
- ☐ Premixed potting media
- ☐ Media components: vermiculite, perlite, peat moss, bark, pumice, sand, Osmocote®
- ☐ Notebooks
- ☐ Writing instruments

You will need to prepare the samples for Part 1 of this activity by placing a small amount (approximately 1 cup) of each of the media components into a quart size Ziploc® bag. Media components include vermiculite, perlite, peat moss, bark, pumice, sand, Osmocote®, and dry potting media. Label each bag with a permanent marker. Students work in pairs for this activity; you will need enough sets to accommodate half of the class enrollment. Media samples can be purchased from Ward's Science or a garden supply center.

Sorting out Potting Soil

Minnesota K-12 Academic Standards

Math	9.2.4	Represent real world and mathematical situations using equations and inequalities involving linear, quadratic, exponential and nth root functions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context.
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Summary/Overview

After learning about the uses and components of potting media, students observe and calculate percentages of potting soil components.

Garden Connection

Potting medias are used to grow container plants. These medias are carefully composed to assist plants in growth.

Background Information

Mineral soils are made up of three main components: sand, silt, and clay in varying quantities depending on where in nature they are located. Mineral soils taken from fields, gardens, or lawns are not suited for container-grown crops because of weight and drainage issues. Excess weight adds management problems and costs for shipping live plant materials. Mineral soils can also be so dense that water holds to the particles too tightly to drain adequately. A good potting media, made up a variety of materials such as perlite, vermiculite, and peat moss, provides a balance of the proper drainage, porosity, and water retention plants require.

Not all potting media mixes are the same. The use of specific mixes varies depending upon the type and the growth stage of plants. Another factor is whether the plant is grown outdoors for a long period of time, such as perennial nursery plants, or indoors, such as houseplants. No matter what the intended use of the media mix is, the goals are still the same: to provide porosity for good aeration and drainage and at the same time hold adequate moisture to prevent the constant need for irrigation.

Objectives

- Understand the purpose of using potting media.
- List the three types of ingredients found in commercial potting media.
- Identify components commonly used in potting media.
- Determine the percentage of ingredients found in potting media.

Procedure

Interest Approach

Display several samples of components of potting soil as prepared for the activity on Handout A. Ask students if they know the names of the samples and the role they play in a potting medium. Explain that this lesson helps them understand the ingredients found in potting media and their purpose.



Summary of Content and Teaching Strategies

Present and discuss Teacher Material A with students. Students take notes in their notebooks.

Divide students into groups of two. Give students copies of Handout A. Provide students with paper towels to place media components on for examination.

Explain how to measure density by calculating mass and volume. Density is equal to mass divided by volume. Explain that when the density of an object is less than the density of water, it will float. The density of water is 1 gram/milliliter.

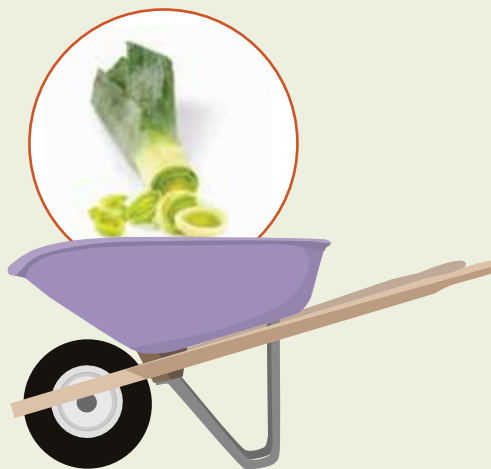
For Part 2, students determine the percentage of components for a premixed potting media. Students need to separate components, identify them, and determine the proportion of each in the mix. You need to provide students a sample of pre-mixed potting media. Answers will vary depending on the media mix you purchase. Garden store mixes that have packaging for the average consumer will provide you a list of ingredients and possibly proportions on the label. Commercial mixes will not provide this information unless you ask the manufacturer.

Review/Summary

Discuss the conclusion questions found on Handout A.

Modifications/Extensions

Conduct an experiment comparing plant growth in a container using potting soil and garden soil. Before the experiment, have students create a hypothesis specifying which plant will do the best. Students should observe plants for several weeks noting plant height, width, and overall health. At the end of their experiment students share results with the class and determine which medium is the best for plants when grown in a container.



Sources/Credits

Adapted from: *Curriculum for Agricultural Science Education (2012) Principles of Agricultural Science – Plant*. [Curriculum materials for secondary agricultural education instruction]. Lexington, KY.

Potting Media Components

Potting media is better suited for growing crops in containers.

Purpose of Using Potting Media

- Light-weight potting media for shipping and handling
- Good porosity for drainage and aeration
- Good water retention to prevent containers from drying out too quickly

Media Ingredients

Three types of ingredients are used in potting media:

- **Inorganic materials** – minerals and substances derived from non-living matter
- **Organic materials** – substances derived from plant or animal tissues
- **Soil enhancers** – includes fertilizers, wetting agents, and soil chemistry buffers

Inorganic Materials

For potting media, inorganic materials are typically volcanic materials, such as:

- Perlite
- Pumice
- Vermiculite

These are lightweight and very porous materials.

Other Inorganic Materials

Besides volcanic materials, human-made materials are used, such as:

- Plastic polymer beads
- Clay beads
- Rockwool

Anything inexpensive, light, and that will not disintegrate in wet conditions.

Organics

Organic materials absorb water and will break down to provide improved porosity.

Common materials used in potting media:

- Peat moss (sphagnum peat)
- Bark chips
- Sawdust
- Coconut fibers
- Seed hulls and husks

Soil Enhancers

Because potting media provides plant roots access to everything they require, media can have enhancers mixed in for efficient plant growth.

Some enhancement amendments:

- Fertilizers
- Wetting agents
- Lime or gypsum

Slow-Release Fertilizers

Potting media can be mixed with time- release fertilizer pellets whose layers melt away over time, providing plants steady nutrients over the length of the growing season.

Common product name is Osmocote®. These look like little round clay pellets.

Purchasing Media

Potting media is typically sold two ways

- Bulk – loose, sold by the cubic yard
- Packaged – compressed in plastic wrapped bales, sold by the cubic foot

References

Boodley, J. W. (1998). *The commercial greenhouse* (2nd ed.). Albany, NY: Delmar.

Parker, R. (2010). *Plant and soil science: Fundamentals and applications*. Clifton Park, NY: Delmar.



Sorting out Potting Soil

You will be investigating the role potting media components have in a container mix. Follow the instructions to determine how to test and collect evidence to support conclusions you determine.

Part 1. Introduction to Ingredients

1. Get a plastic bag of each media ingredient: bark, peat moss, perlite, pumice, sand, slow release fertilizer (Osmocote®), and vermiculite.
2. Examine each sample and record observations in Table 1. Observations should include color and other features (for example size and shape) that will help you to identify the material within a potting media mix. Density will be calculated in step thirteen.
3. Determine the mass of the 30ml cup and record in the second column of Table 2.
4. Place a small amount of one of the media ingredients in a cup. Determine the mass of the cup and media and record in Table 2.
5. Record the mass of the media by subtracting the mass of the cup from the mass of the media and cup. Record this amount in Table 2.
6. Pour 50ml of water into a 100ml graduated cylinder.
7. Place the media from the 30ml cup into the graduated cylinder.
8. Record the volume of the water and the media in Table 2.
9. Calculate the volume of the media by using the following formula:
10. (Volume of water and media found in step 7) – 50ml = volume of media
11. Record the volume of the media in Table 2.
12. Repeat Steps 2–9 for each media ingredient.
13. Calculate the density of each ingredient by taking the mass of the media divided by the volume of the media. Record the value in Table 1.

$$\text{Formula for density} = \frac{\text{Mass of media}}{\text{Volume of media}}$$

Materials

Per pair of students:

- ☐ Media samples
- ☐ 30ml cup
- ☐ 100ml graduated cylinder
- ☐ Electronic scales

Per student:

- ☐ Calculator
- ☐ Pencil
- ☐ Notebook

Part 2. Determining Percentage of Components

1. Get a sample of a potting media mix from your teacher.
2. You and your partner need to come up with a way to separate the components of the media to calculate the percentage of each component.
3. Start with a known volume or mass (you choose which variable) of potting media mix and determine the volume or mass for each component.
4. Divide the volume or mass of each component by the whole sample volume or mass to get the percentage for each. Use the formula below to determine percentages of components.

$$\text{volume or mass of component} \div \text{volume or mass of whole sample} = \% \text{ of component}$$

5. Record the data in Table 3.

Table 1. Physical characteristics of components			
Ingredient	color	other	Density
Bark			
Osmocote®			
Peat Moss			
Perlite			
Pumice			
Sand			
Vermiculite			

Table 2. Mass and Volume of Media					
Ingredient	Mass of Media & Cup	Mass of Cup	Mass of Media	Volume of Media & Water	Volume of Media
Bark					
Osmocote®					
Peat Moss					
Perlite					
Pumice					
Sand					
Vermiculite					

Table 3. Percentage of components in a Mix		
Substance	Volume or Weight	Percentage of Mix
Potting Soil Mix		100%

conclusion

Large diameter sand provides a great natural soil amendment to improve porosity. Discuss the limitations sand has in potting mixes.

List some organic materials found in your local area that may be substituted for some of the materials you studied in Part 1 of this activity. Your substituted materials must stay consistent with the same desired functions.

If you were trying to grow a plant that was very sensitive to excessive soil moisture, which ingredients would you increase the percentage of in the potting mix?

Why should peat moss be used for a mix growing young seedlings?

What are the similarities in terms of function for the different organic materials?

Name _____

Sorting out Potting Soil



1. List two of the three purposes of using potting media.

2. List the three types of ingredients found in potting media.

3. Name two organic components commonly used in potting media.

4. Explain how slow-release fertilizer works.
